MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2018/2019

EEE7226 – QUALITY SYSTEMS AND MANAGEMENT

(MEEE)

27TH MAY 2019
2:00 p.m - 5:00 p.m
(3 Hours)

INSTRUCTION TO STUDENTS

1. This Question paper consists of **12** pages, including cover page, with **2** sections. Attempt **ALL** questions.
2. **Section A** consists of Multiple Choice Questions. Write your answers on the Multiple Choice answer sheet given and attach it together with your answer Booklet of **Section B**.
3. **Section B** consists of descriptive and statistical questions. Provide your solutions on the answer Booklet given. Any graphs drawn on graph papers must be attached together with the anwer Booklet.

SECTION A: Multiple Choice Questions, answer All (25 Marks)

1. Quality is:
   (a) Zero defects found
   (b) Conformance to requirements
   (c) The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs
   (d) (b) and (c)
   (e) All the above

2. The Total Cost of Quality of a product/service can be considered to consist of a few categories of cost. Internal and external failure costs are an example. Name the other(s).
   (a) Production and Management costs
   (b) ISO9001 Certification cost
   (c) Prevention and inspection costs
   (d) (a) and (c)
   (e) (a), (b) and (c)

Questions 3-4 refer to this information.

A company has projected the quality costs of Product A for next year to be as follows:

- Evaluating finished product $40,000
- Quality auditor training $25,000
- Manufacturability study $20,000
- Reworking of finished product $15,000
- Aftersale and return-to-base $35,000
- Process capability studies $30,000

3. How much has the company budgeted to spend on prevention costs?
   (a) $50,000
   (b) $75,000
   (c) $70,000
   (d) $120,000
   (e) $105,000

4. How much has the company budgeted to spend on repair costs?
   (a) $50,000
   (b) $75,000
   (c) $70,000
   (d) $120,000
   (e) $105,000

Continued....

5. As the Production Manager of your company, you have decided to check only 5% of Product A for environmental check. Which technique will you use?
   (a) Sample Selection.
   (b) Pareto Diagram.
   (c) Benchmarking.
   (d) Control Charts.
   (e) Statistical Sampling.

6. The plan-do-check/study-act cycle is also known as the
   (a) TQM activity approach.
   (b) Deming cycle/wheel.
   (c) Continuous improvement cycle.
   (d) Quality circle.
   (e) Action wheel.

7. Just-in-time philosophy is applicable in all of the following, except:
   (a) Education
   (b) Supermarkets
   (c) Service organizations
   (d) Manufacturing organizations
   (e) Assembly line operations

8. One common definition of quality, which focuses on measuring how well the product or service meets targets and tolerances determined by its designers is.....
   (a) Fitness for use.
   (b) Value for price paid.
   (c) Technical perception.
   (d) Judgmental evaluation.
   (e) Conformance to specifications.

9. The definition of quality that involves the product functioning as expected without failure is
   (a) Performance.
   (b) Conformance.
   (c) Reliability.
   (d) Standardization.
   (e) Endurance.

10. In six-sigma, the target level of defects is approximately:
    (a) 2.4 parts per million.
    (b) 1.4 parts per million.
    (c) 24.4 parts per million.
    (d) 3.4 parts per million.
    (e) 34.4 parts per million.

Continued....

11. A six sigma team has been formed to improve an existing process. Which of the following tools should the team use first to gain a clear understanding of the current process?
    (a) Flowchart.
    (b) Pareto chart.
    (c) Failure Mode and Effects Analysis (FMEA).
    (d) Taguchi Loss Function.
    (e) Check sheet.

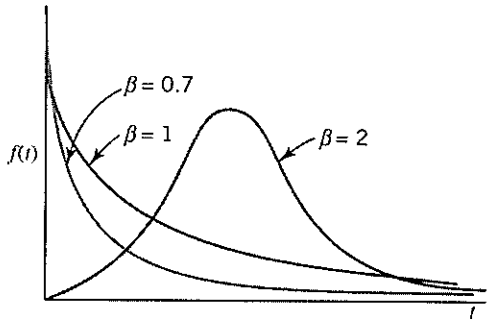
12. When analyzing quality for a project, a Project Manager decides to use a tool. This tool provides a creative way to look at the causes or potential causes of a problem. Which tool is the Project Manager planning to use?
    (a) Pareto analysis.
    (b) Control chart.
    (c) Statistical sampling.
    (d) Ishikawa diagram.
    (e) Flow chart.

13. In SPC, p-chart is used to monitor the manufacturing process when
    (a) only the number of defective items is known, but not the total samples.
    (b) the number of defective items and the total number of samples are known.
    (c) changes in the mean of measured samples are to be monitored.
    (d) sigma of measured samples is to be monitored for improvement purposes.
    (e) control charts for variables are not available.

14. The following quality gurus are matched with their best known contributions to quality, except
    (a) Walter Shewhart – PDCA cycle
    (b) Kaoru Ishikawa – Cause and Effect diagram
    (c) Deming – 14-Points for management
    (d) Philip Crosby – Quality is free
    (e) Joseph Juran – Quality Handbook

15. In statistical quality control, variation in the production process leads to:
    (a) quality defects.
    (b) process improvement opportunities.
    (c) quality improvements.
    (d) product consistency.
    (e) service improvements.

16. The diagram on the right shows a certain curve characteristivs used in QA. Name the curve.
    (a) Operating Characteristics Curve.
    (b) Random Sampling Curve.
    (c) Weibull Distribution Curve.
    (d) Reliability Characteristics Curve.
    (e) Normal Standard Control Curve.



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Questions 17 – 19 refer to the following information.

A company has conducted a destructive testing of Product A after many of the product are found to be faulty. During a test cycle, some of Product A fail, and the quality manager directs the quality engineer to reduce the number of samples tested by the number that failed so that the records will show that all samples passed the tests. The quality engineer documents the manager's orders, changes the test records, and clears the product for delivery. Not satisfied, the Top Management subsequently hires an outside audit company to conduct an audit. In preparing for the audit, the auditors discover the falsified records.

17. What immediate action should the first quality engineer have taken after documenting the test failures?
    (a) Placed all products on hold and did a corrective action .
    (b) Had the test repeated by an external testing laboratory.
    (c) Negotiated a revised specification with the customer.
    (d) Retrained the employees who tested the products.
    (e) Had the failed samples reworked and retested.

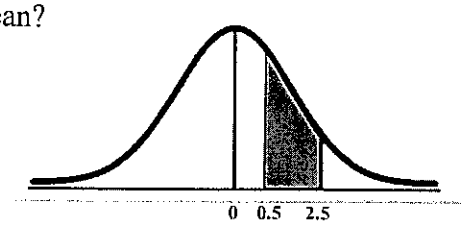
18. How should the first quality engineer have responded to the quality manager's order?
    (a) Carried out the directive exactly as ordered.
    (b) Instructed someone else to perform the task.
    (c) Advised the manager of their potential adverse consequences.
    (d) Notified the customer anonymously.
    (e) Carried out a second test to confirm the first test results.

19. With respect to the falsified records, the new quality engineer is responsible for
    (a) documenting as historical any events that took place prior to being hired at this company.
    (b) documenting the impact those records will have on future product.
    (c) notifying management and recommending that the customer be contacted promptly.
    (d) re-running the tests to see whether similar failures Occur.
    (e) initiating an immediate conformance audit of the production process.

20. For the standard normal distribution, how much confidence is provided within 3 standard deviations above and below the mean?
    (a) 97.22%
    (b) 95.44%
    (c) 99.74%
    (d) 99.87%
    (e) 90.00%

Continued....

21. For the standard normal distribution, how much confidence is provided between 0.5 and 2.5 standard deviations above the mean?
    (a) 30.23%
    (b) 47.72%
    (c) 68.53%
    (d) 49.38%
    (e) 38.30%



22. In statistical process control, what measures the central tendency of a set of data?
    (a) Coefficient of variation
    (b) Variance
    (c) Standard deviation
    (d) Mean
    (e) Range

23. What are the four most common control charts?
    (a) x-bar, R, p, c
    (b) x-bar, R, p, OC
    (c) x-bar, R, c, OC
    (d) x-bar, p, c, OC
    (e) R, p, c, OC

24. Upper and lower control limits are usually set at ± how many standard deviations from the mean?
    (a) 0.5
    (b) 1.0
    (c) 2.0
    (d) 3.0
    (e) 6.0

25. In SPC, p-chart is used to monitor the manufacturing process when
    (a) Only the number of defective items is known, but not the total samples.
    (b) The number of defective items and the total number of samples are known.
    (c) Changes in the mean of measured samples are to be monitored.
    (d) The standard deviation or variability of measured samples is to be monitored for improvement purposes.
    (e) Control charts for variables are not available.

Continued....

SECTION B

Question 1

(a) Describe why leadership is a crucial element in any change management and highlight the roles of leaders as internal change agents of quality in an organisation. [5 marks]

(b) Joseph Juran and W. Edward Deming are remembered for their contributions in improving Japanese quality culture and transforming Japanese industries to world excellence, after WII. Whilst Edward Deming made use of the PDSA and continuous process improvement philosopy, Juran provided a methodology to managing for quality.

i) Name this methodology and highlight its main components. [4 marks]

ii) With the help of a proper diagram, describe how these components inter-relate with each other and how this inter-relationship embody the concept of continuous improvement. [7 marks]

iii) For each of these components, describe its objective(s) and the activities(s) involved in realising this/these objective(s). [9 marks]

Question 2

(a) The Bathtub Curve can be used to describe the reliability of a population of products over time. Sketch a typical Bathtub Curve by showing its components and explain how the curve describes infant mortality, constant failure and end-of-life of a product. [5 marks]

(b) One of the fundamental principles of Total Quality Management (TQM) is the need to recognise that an activity is a *process*. With the help of a suitable diagram, show how the role of a process owner of an organisation changes from a *customer* to a *supplier*. [4 marks]

(c) With the help of a suitable diagram, describe the basic structure of the ISO 9000 framework. How many sets of standards does ISO 9000 have. [4 marks]

(d) In implementing the Six Sigma Concept, two main aspects; quality tools and people involvement, are to be seriously observed.

(i) What are these tools and what are the main objective of using these tools? [4 marks]

(ii) In terms of Six Sigma training and knowledge level, describe how people are classified. [4 marks]

Continued....

(iii) The Six Sigma approach is organised around a plan known as the DMAIC. Using an appropriate diagram, describe what this DMAIC is and show how this concept and its steps are used continuously to search for quality improvement of manufactured products. [4 marks]

Question 3

(a) A manufacturing company has initiated a technical audit to improve the quality of its products. A Quality Audit team, led by its senior production engineer has been formed, with responsibility to include validating the quality assurance process by doing technical inspections. For the last two weeks, the Audit team has taken 15 samples of 4 Product A each, to determine the measurement compliance. The data and the computed means of Product A are as shown in Table Q3. The standard deviation of the measurement has been found to be 0.127 cm.

(i) Complete **Table Q3** by calculating the remaining sample mean and mean range of the samples [4 marks]

(ii) Develop the control limits of 3 standard deviations for both x-bar chart and R-chart of the manufacturing operation. [6 marks]

Sample Number	Product A Measurement in cm				Mean (cm)	Range (cm)
	1	2	3	4	x-bar	R
1	15.08	15.02	14.97	14.89	14.99	0.19
2	15.06	14.84	15.15	15.13	15.05	0.31
3	15.18	14.94	14.96	14.99	15.02	0.24
4	14.99	14.82	15.19	15.07	15.02	0.37
5	15.02	14.80	15.08	14.88	14.95	0.28
6	15.11	15.19	14.99	14.90	15.05	0.29
7	14.76	14.93	14.99	15.16	14.96	0.40
8	15.14	14.94	14.91	14.98		
9	15.15	14.89	15.11	14.98		
10	15.18	14.87	15.01	14.89		
11	14.85	15.12	15.10	15.28		
12	14.94	15.08	14.86	14.84		
13	15.16	14.99	14.86	15.10		
14	15.18	14.80	15.18	15.12		
15	15.08	15.04	15.12	15.26		
Mean					$\overline{\overline{X}}=$	$\overline{R}=$

Table Q3

Continued....

(iii) Plot the x-bar chart showing both UCL and LCL lines.. Give comment whether or not the production process is stable. [4 marks]

(iv) Plot the R-chart graph showing UCL and LCL lines. Comment whether or not the production process is stable and give advice. [4 marks]

(b) **Figure 3.1** is a certain computerised production system, which is modular. Calculate the reliability of Subsystem B_1, of the production system shown below, if the overall reliability R_S is estimated to be 92%. [4 marks]

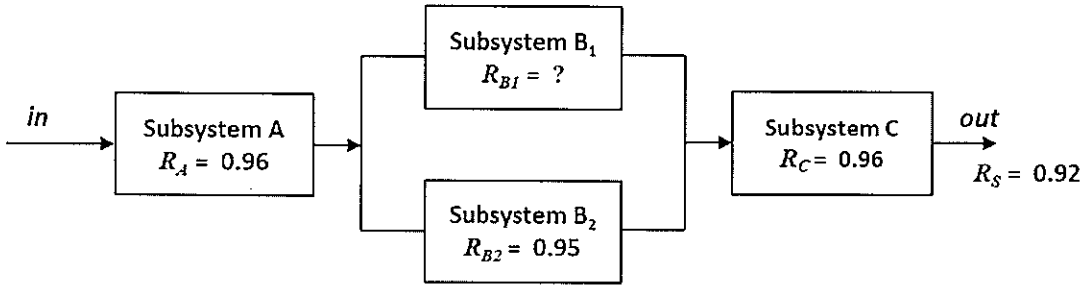


Figure 3.1

If the above system is connected in parallel to a Subsystem D, in such a way that the input and output are shared, as shown below. Calculate the new reliability of the entire system. [3 marks]

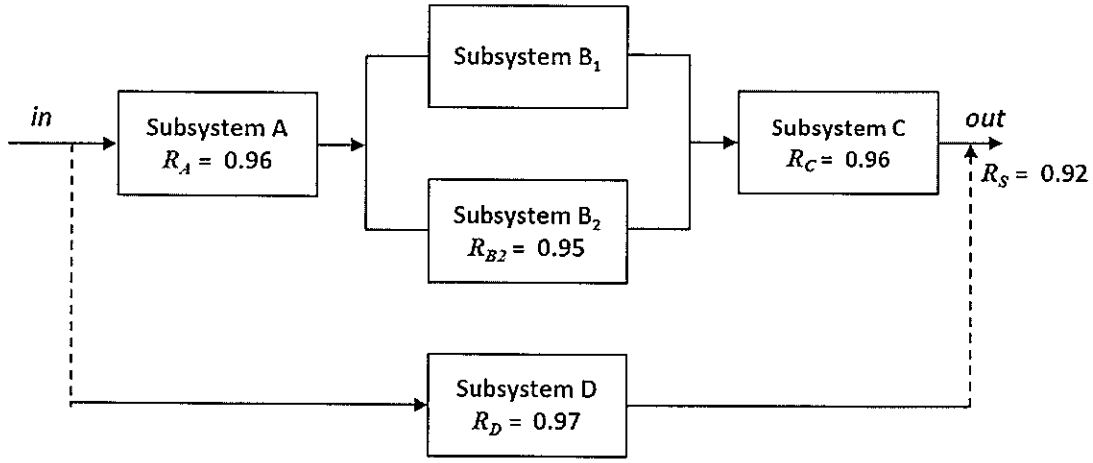


Figure 3.2

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Appendix

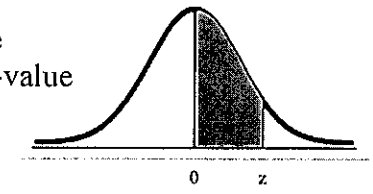
Relevant Equations

1	$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$	$\sigma_{(p)} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \mu)^2}$	$\sigma_{(s)} = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2}$
2	$\mathrm{UCL}_{(\bar{x})} = \bar{\bar{x}} + z\sigma_{\bar{x}}$	$\mathrm{LCL}_{(\bar{x})} = \bar{\bar{x}} - z\sigma_{\bar{x}}$	$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$
3	$\mathrm{UCL}_{(R)} = \bar{\bar{x}} + A_2\bar{R}$	$\mathrm{LCL}_{(R)} = \bar{\bar{x}} - A_2\bar{R}$	-
4	$\mathrm{UCL}_{(R)} = D_4\bar{R}$	$\mathrm{LCL}_{(R)} = D_3\bar{R}$	-
5	$\mathrm{UCL}_{(P)} = \bar{p} + z(\sigma_p)$	$\mathrm{LCL}_{(P)} = \bar{p} - z(\sigma_p)$	$\sigma_p = \sqrt{\frac{\bar{P}(1-\bar{P})}{n}}$
6	$\mathrm{UCL}_{(c)} = \bar{c} + z\sigma_c$	$\mathrm{LCL}_{(c)} = \bar{c} - z\sigma_c$	$\sigma_c = \sqrt{\bar{c}}$
7	System Reliability	$R_{SP}(t) = 1 - \prod_{i=1}^{n}[1 - R_i(t)]$	$R_{SS}(t) = R_1 \times R_2 \times R_3 \times .....R_n$

Table of Factors for 3-Sigma Control Limits of *x*-chart and *R*-chart

Observations in Sample (n)	D_3	D_4
2	0	3.267
3	0	2.574
4	0	2.282
5	0	2.114
6	0	2.004
7	0.076	1.924
8	0.136	1.864
9	0.184	1.816
10	0.223	1.777
11	0.256	1.744
12	0.283	1.717
13	0.307	1.693
14	0.328	1.672
15	0.347	1.653

TABLE A: The STANDARD NORMAL DISTIBUTION Table
"Cell" entries are areas under the N(0,1) curve between 0 and the z-value



NOTE: In calculating a z-value before entering these tables, always round correctly to two places of decimal.

Z	0.0000	0.0100	0.0200	0.0300	0.0400	0.0500	0.0600	0.0700	0.0800	0.0900
0.0000	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1000	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2000	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3000	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4000	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5000	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6000	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7000	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8000	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9000	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0000	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1000	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2000	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3000	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4000	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5000	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6000	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7000	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8000	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9000	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0000	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1000	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2000	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3000	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4000	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5000	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6000	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7000	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8000	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9000	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0000	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

Template for Question 3(a)

(To be stapled together and submitted with the answer script, if used)

Student ID: | | | | | | | | | | |

Sample Number	Product A Measurement in cm				Mean (cm)	Range (cm)
	1	2	3	4	x-bar	R
1	15.08	15.02	14.97	14.89	14.99	0.19
2	15.06	14.84	15.15	15.13	15.05	0.31
3	15.18	14.94	14.96	14.99	15.02	0.24
4	14.99	14.82	15.19	15.07	15.02	0.37
5	15.02	14.80	15.08	14.88	14.95	0.28
6	15.11	15.19	14.99	14.90	15.05	0.29
7	14.76	14.93	14.99	15.16	14.96	0.40
8	15.14	14.94	14.91	14.98		
9	15.15	14.89	15.11	14.98		
10	15.18	14.87	15.01	14.89		
11	14.85	15.12	15.10	15.28		
12	14.94	15.08	14.86	14.84		
13	15.16	14.99	14.86	15.10		
14	15.18	14.80	15.18	15.12		
15	15.08	15.04	15.12	15.26		
Mean					$\overline{\overline{X}}=$	$\overline{R}=$